100-N Operable Unit Background & History

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100-NR-1 / NR-2 Operable Unit

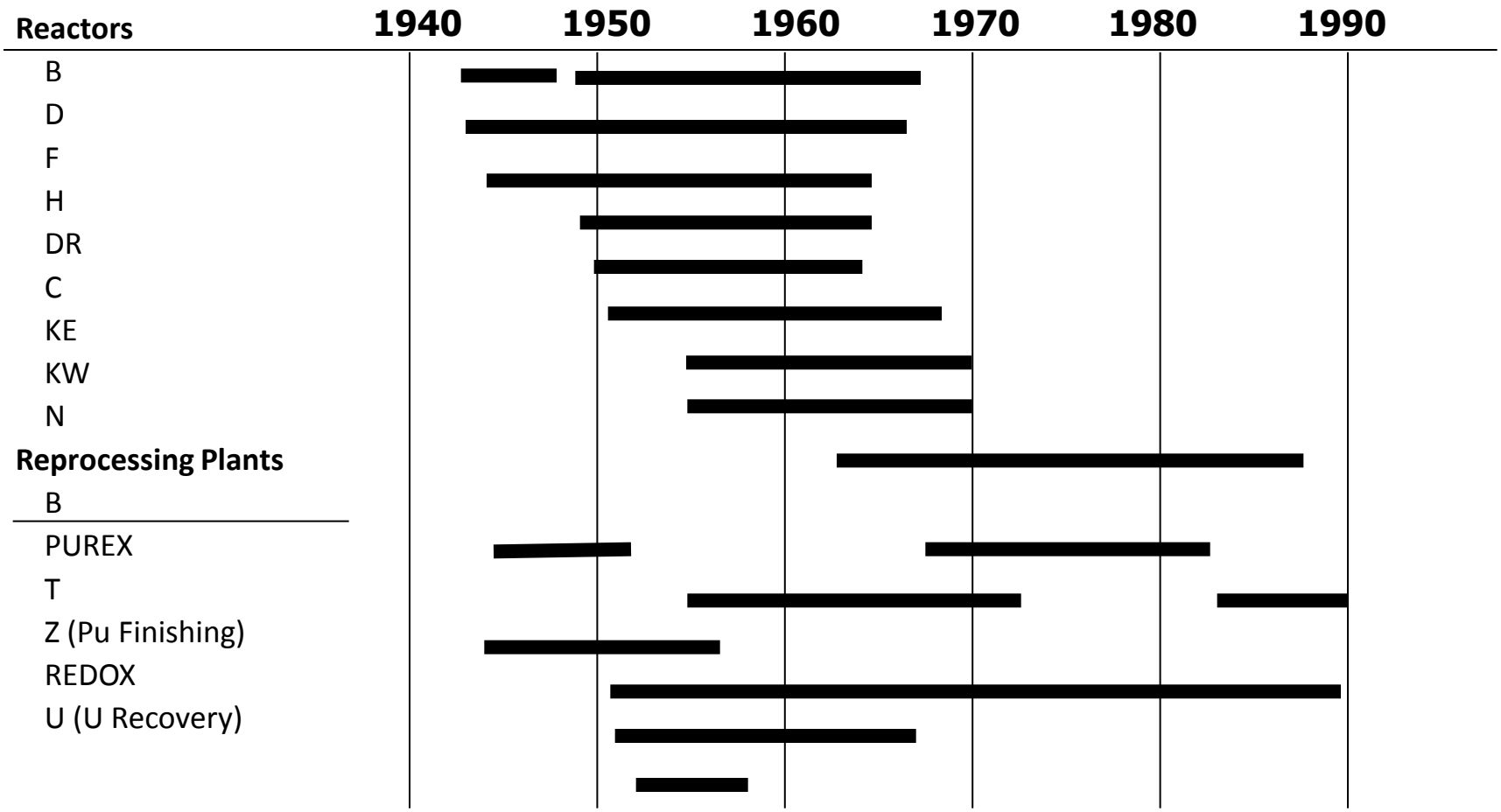
- **234 facilities**
- **175 waste sites**
- **4 RCRA designated TSD facilities ***
- **Sr-90 GW plume unique to this operable unit**
- **1966 Petroleum spill**
- **No persistent chromium plume in groundwater**

* RCRA TSD's: 1301-N & 1325N LWDF's, 1324-N Surface Impoundment & 1324 NA Percolation Pond

N Reactor Operational History

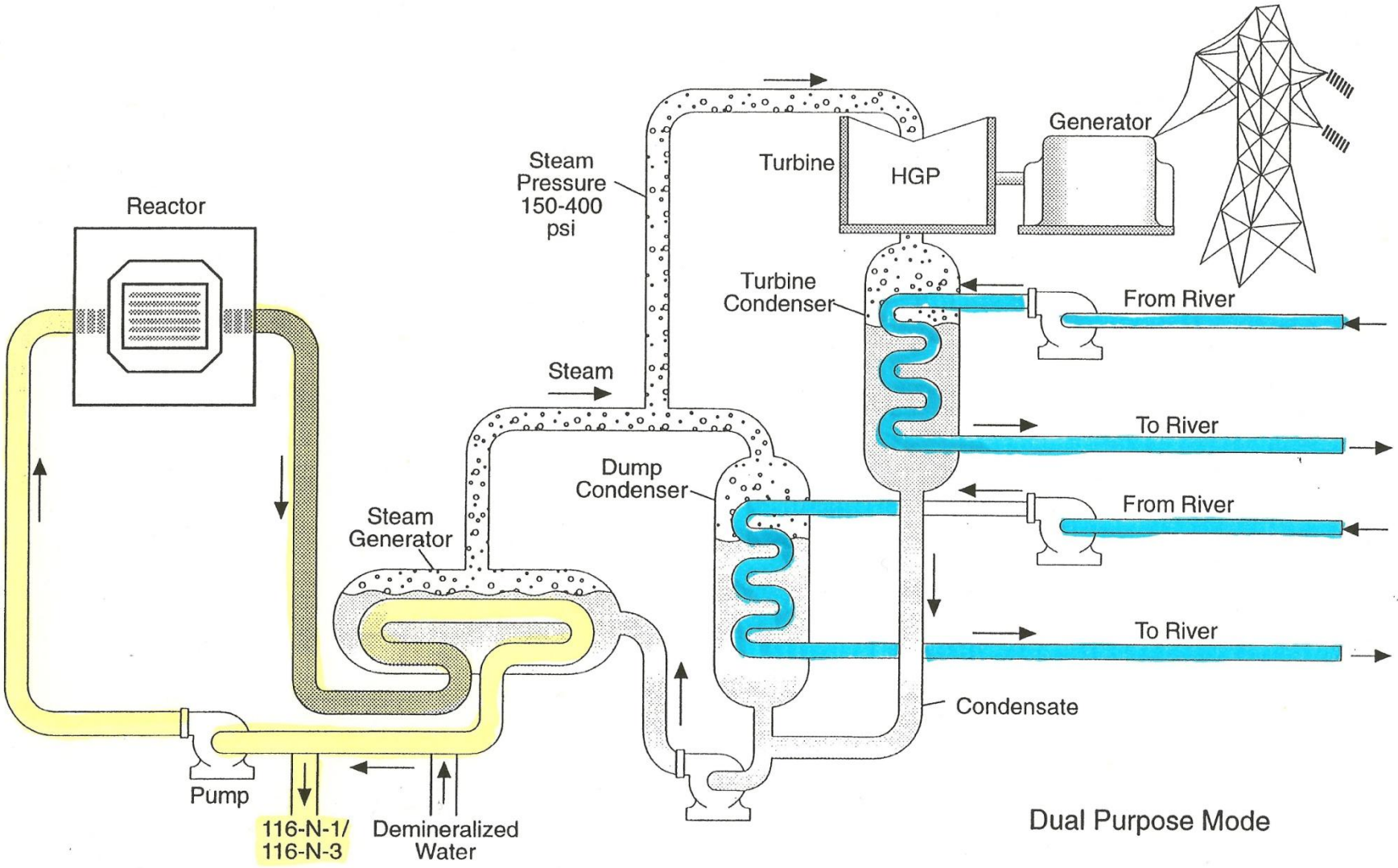
- Reactor constructed from 1958-1963
- Full Production started January 1964
- Operated continuously until January 1987
- Placed in Cold Standby Feb. 1988
- Shutdown order issued Sept. 1991

Operation History for Hanford Facilities



100-N Reactor Liquid Waste Practices

- De-ionized water used for reactor coolant
- Non-radioactive secondary cooling water disposed directly to the river
- 1% of primary cooling water replaced on a continuous basis with secondary cooling water
- Primary coolant passed through N reactor the equivalent of 100 times instead of once in the other single-pass reactors
- Primary coolant discharged to soil column (Feed and Bleed)



Source: WHC 1989a.

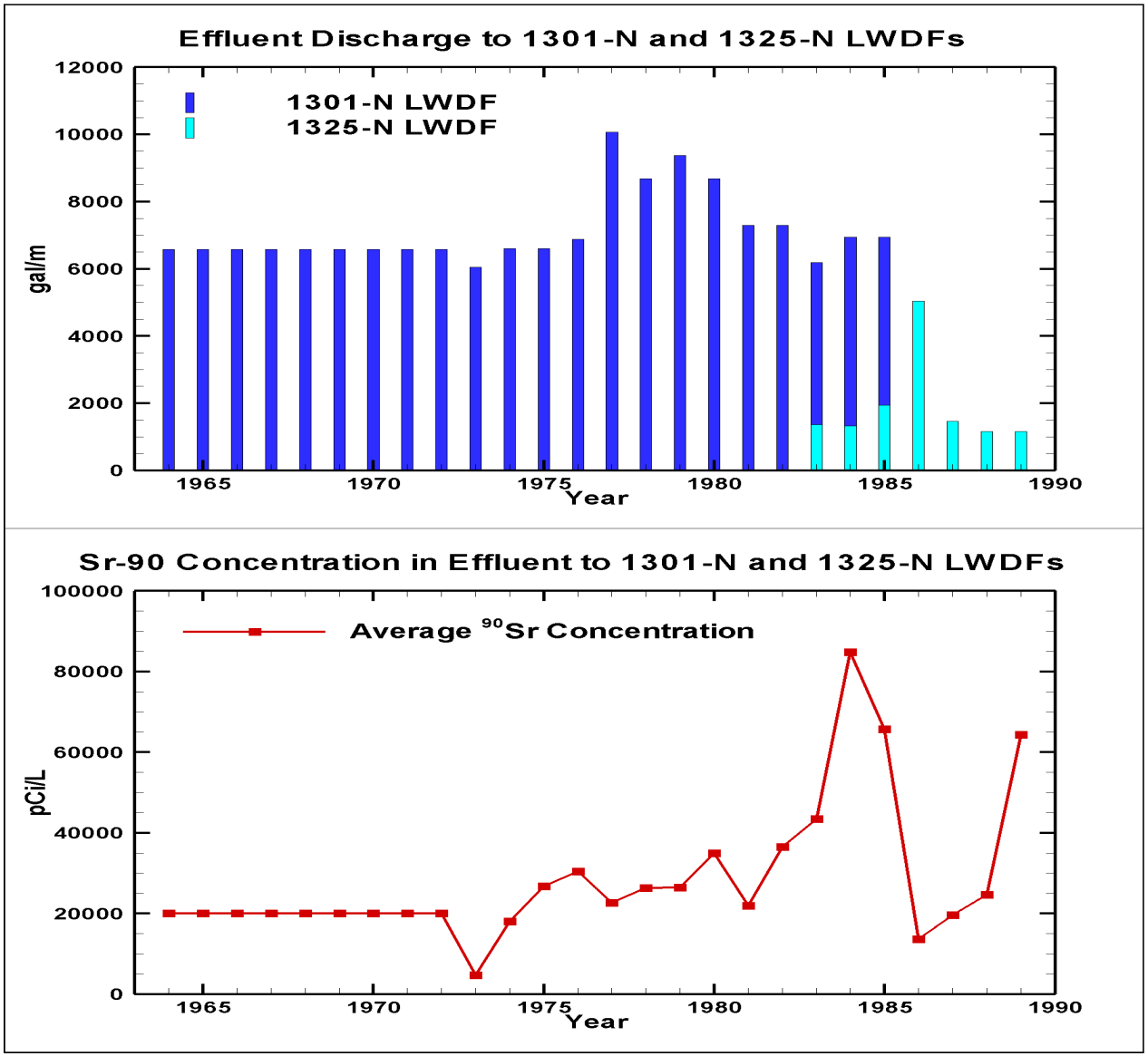
903 1276/27108/2-28-94

Overflow from Irradiated Fuel Storage Basin was a large contributor of Sr-90 inventory to LWDF's

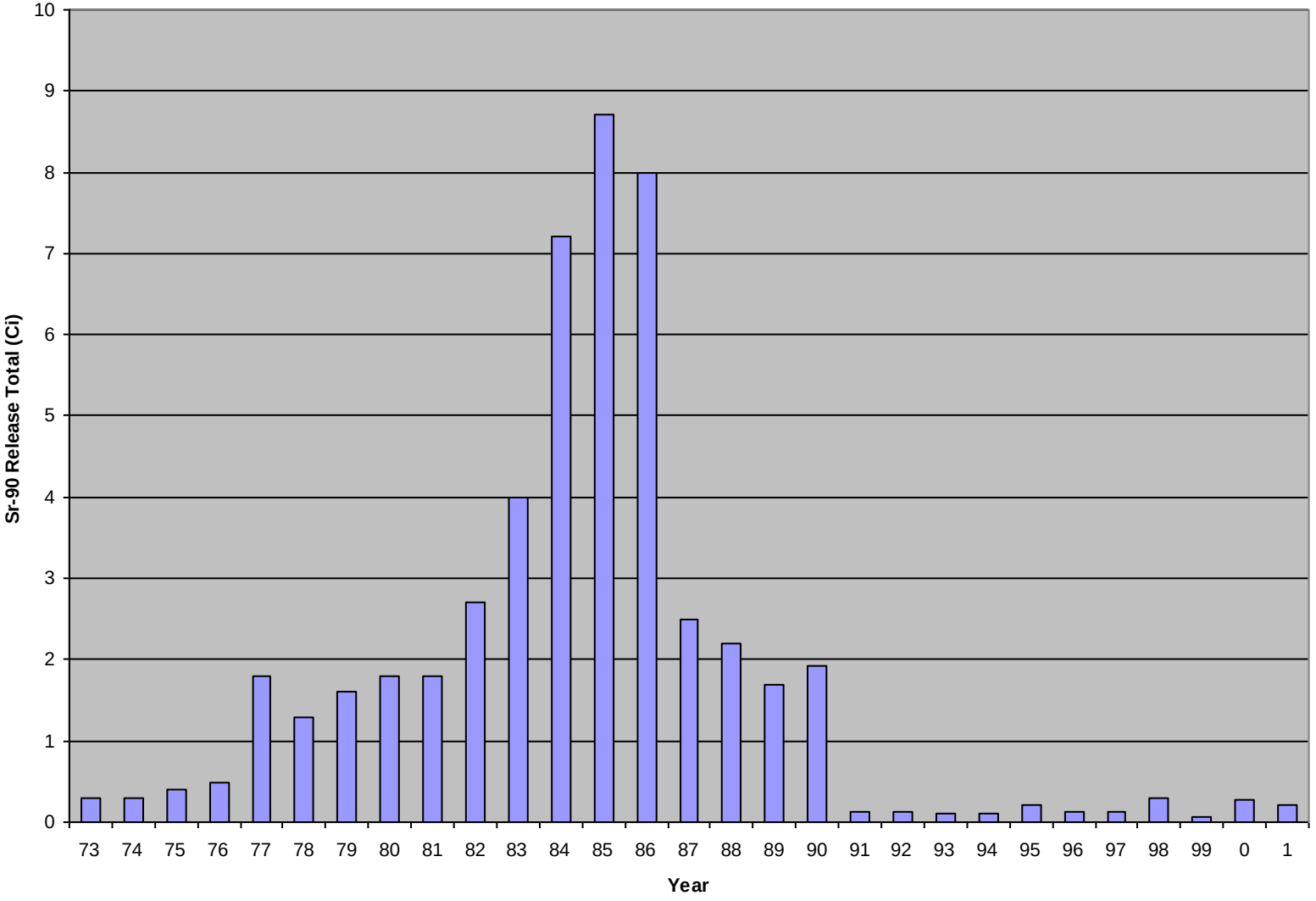
Liquid Waste Disposal Practices

- **Primary coolant disposed to 1301 Crib and trench from 1963-to 1983**
- **1325-N Crib built as replacement in 1983**
- **1325-N Crib expanded with the addition of a 2700 ft. trench in 1985**
- **Ion Exchange regenerate solution from river water treatment disposed to 1324-N/ NA pond**
- **All liquid discharges cease January 1992**

Effluent Disposed to 1301-N & 1325-N LWDF



Sr-90 Releases to the Columbia River



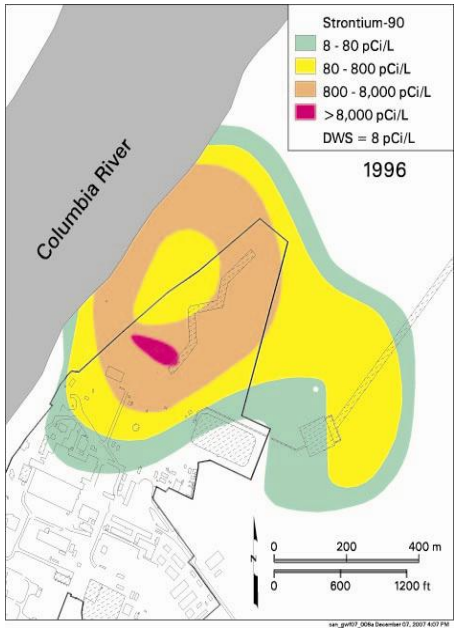
100 N Area Environmental Issues

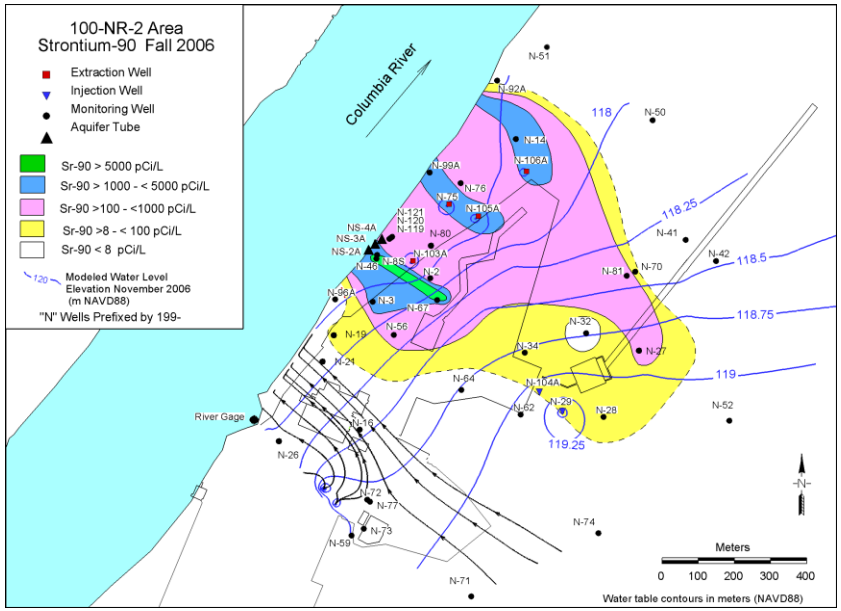
- Strontium-90 concentrations at N Springs reaches 5,000 pCi/ liter in 1985
- Strontium-90 groundwater plume concentrations peaked in excess of 45,000 pCi/ liter beneath 1325-N in late 1989
- Persistent Strontium-90 plume; max concentration ~ 1,000X MCL

Strontium-90 Plume Maps

Sr-90 plume over time

1996

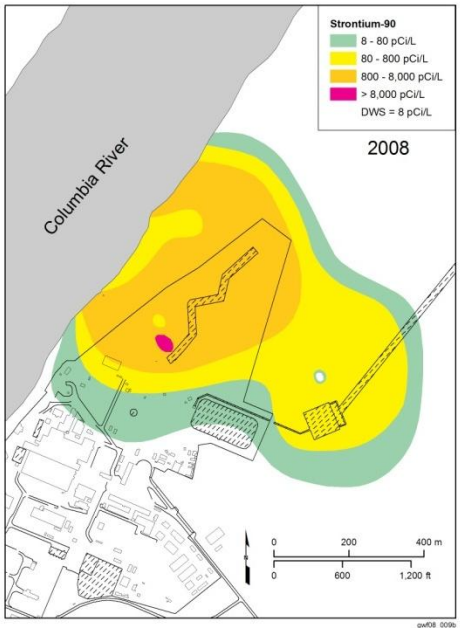




Fall 2006

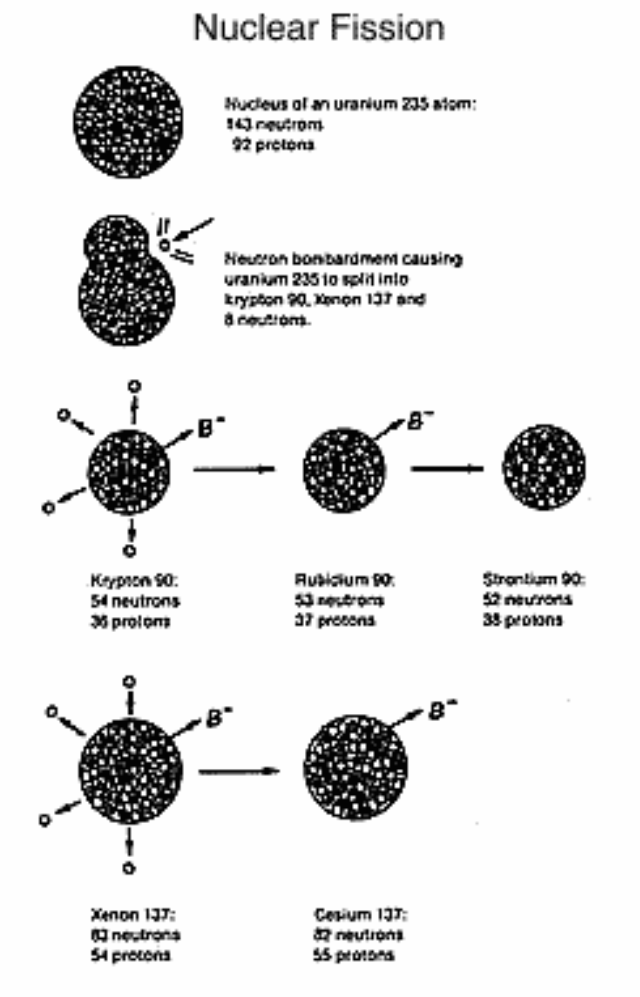
Very little change over time, especially since P&T placed in cold standby

2008



Strontium-90

- Sr-90 is a fission product
- 29.1 year half-life, beta emitter
  - Decays to Yitrium-90 (64 Hr half-life & higher energy beta emitter) then decays to stable zirconium
  - 50% reduction of Sr-90 activity in less than 30 years
  - 90% reduction of Sr-90 activity in less than 95 years
- Behaves biologically similar to calcium
  - ~ 2 Yr biological half-life in infants
  - ~ 5-10 Yr biological half-life in adolescents and adults
- Average world-wide concentration in soil = 0.1 pCi/g
- U.S. average concentration in surface water is 1.9 pCi/L
- U.S. average concentration in groundwater is 0.5 pCi/L



100-N Mulberries 1990

Skyshine at 100-N

- Off-site direct radiation doses (skyshine) exceeded 25 mrem annual dose limit
- Radioactive decay (Co-60) and removal actions have resulted in dose decrease to allowable limits
- TPA Milestone M-016-12A Complete implementation of skyshine abatement action Sept 1996
- TPA Milestone M-016-12F Complete dose reduction activities…by decontamination of 1304-N emergency dump tank Sept 1995

Tritium at 100-N

- ~6,500 Ci tritium discharged to 1301-N and 1325N cribs
- Max conc. In GW was 400,000 pCi/L in 1972 (Well 199-N-3)
- Tritium concentrations reduced to below DWS except for 1 well (22,000 pCi/L Well 199-N-32)

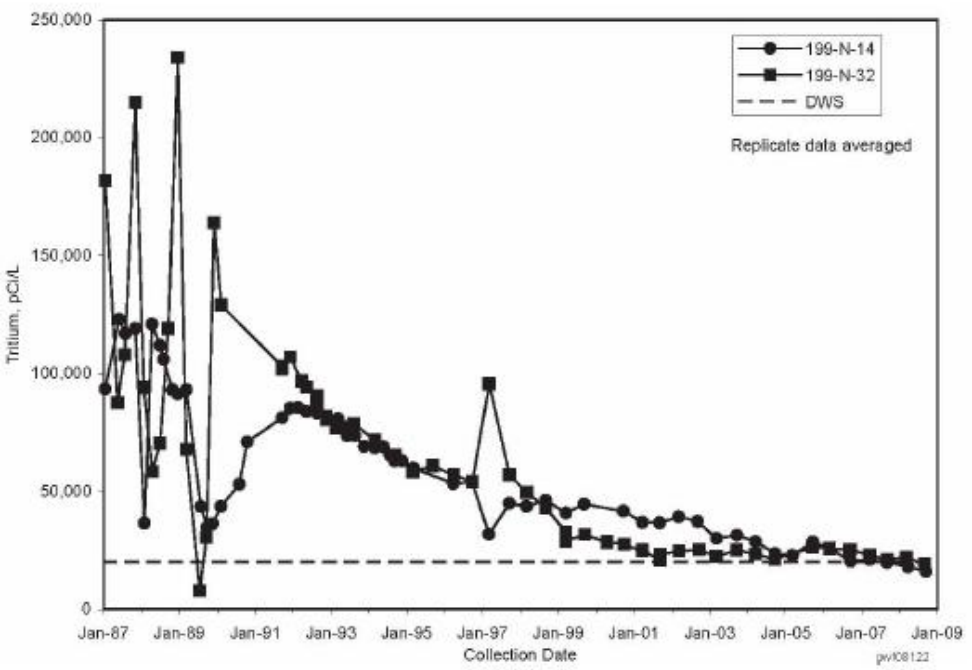


Figure 2-28. Tritium Concentrations in Groundwater near the 116-N-1 and 116-N-3 Waste Sites

Why is there No Persistent Chromium Plume at 100-N?

- New alloys and materials reduced need for corrosion inhibitors by 100X compared to other 100 Area reactors
- Sodium dichromate only used in primary (recirculation) cooling loop; discontinued in 1972
- 54K lbs chromium discharged to 1301-N; flushed by **21 BILLION GALLONS** of water; 10 yrs of chromium-free discharge

1966 Fuel Oil Spill

- **~80,000 gal of Diesel spilled in 166-N Tank Farm ***
- **Interception Trench collected & burned oil through 1967**
- **ROD for Interim Action requires sorbing free product in wells**
- **Characterization & remediation efforts underway**

* Multiple spills of diesel & #6 Fuel oil reported – this is the largest